

solution; growth retarded on culture medium containing 2½ per cent sodium chloride, no growth on culture medium containing 5 per cent sodium chloride; vitality on most culture media short. Acid, but no gas produced with glucose, sucrose, d-mannose, d-galactose and d-mannitol; no acid or gas produced with fructose, lactose, and dextrin. Starch not hydrolyzed, indol and hydrogen sulphide not produced; nitrates reduced to nitrites and nitrites to ammonia. Maximum temperature for growth 31° C., minimum 7° C. and optimum 22° C. Maximum pH for growth 9.2, minimum 5.4 and optimum 6.03. Pathogenic on *Umbellularia californica* Nutt. causing angular leaf spots; also pathogenic on leaves of avocado, *Persea drymifolia* Cham. and Schlecht. following inoculation. Specific name refers to the fact that both host plants belong to the family Lauraceae. Culture deposited with the American Type Culture Collection.

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## HOWELLANTHUS, A NEW SUBGENUS OF PHACELIA

LINCOLN CONSTANCE

*Phacelia Dalesiana* J. T. Howell, published (1937) under the title, "A Remarkable New *Phacelia*," fully lives up to the descriptive adjective. Although the author referred this northern California species to section *Euphacelia* "on characters of flowers and ovules," it was clear to him at the time that it was unique in many respects, and he has assured me that only its apparent similarity to "some otherwise entirely unrelated Mexican species" prevented him from describing it as a monotypic new genus. The possession of true interstaminal corolla scales and paired ovules afford it technical admission to *Euphacelia*, but it comprises a markedly discordant element in that section.

The writer's recent study of the subgenus *Cosmanthus* (1949) has provided data to permit comparison with the Mexican species mentioned above, and the cytological data accumulated by Cave and Constance (1942, 1944, 1947, 1950) afford a basis for contrasting *Phacelia Dalesiana* with other species and genera of Hydrophyllaceae in respect to chromosome number.

The following review of characters roughly parallels that employed for the species of *Cosmanthus*.

**HABIT.** The habit of *Phacelia Dalesiana* (fig. 1, a), a deep-rooted, acaulescent perennial herb arising from a more or less definite basal rosette of entire leaves, superficially resembles that of the Mexican *P. (Cosmanthus) platycarpa* and the genera *Hesperochiron* and *Tricardia*. No other western American *Phacelia* bears any close resemblance in this respect. Depressed forms of the *P. magellanica* complex may have both the acaulescent habit and the basal rosette of entire leaves, but in these the inflorescence is congested-scorpioid and the leaves are unmistakably characteristic of this rather discrete group. Some annual species of *Phacelia* share the entire basal leaves, but the habitual distinction remains striking.

**INFLORESCENCE.** The few-flowered, lax inflorescence (fig. 1, a) is a little reminiscent of such annual species as *P. Eisenii*, *P. orogenes*, *P. Pringlei*, and *P. racemosa*, which also have deeply parted styles, as does *P. Dalesiana*.

**GLANDS AND COROLLA SCALES.** *Cosmanthus* is unique within *Phacelia* by its possession of a flap-bordered gland proximal to each corolla lobe, and there are no corolla scales present. *Phacelia Dalesiana*, on the other hand, is entirely devoid of these glands on the corolla, but has extremely well developed interstaminal scales (fig. 1, b). This species thus differs from *Cosmanthus* in the single morphological character peculiar to and distinctive of that subgenus. True interstaminal scales are, however, found in most species comprising sections *Eutoca*, *Euphacelia*, and *Euglypta*.

**PUBESCENCE.** *Phacelia Dalesiana* is more or less hirsutulous and slightly viscid, with an indument suggestive of that of *P. (Cosmanthus) dubia*, and the stamens are entirely glabrous. Neither of these conditions, however, is particularly distinctive in the genus as a whole.

**OVULES AND SEEDS.** Howell has emphasized the unique feature of the pendent attachment of the ovules at the summit of the placental ridges, and the production of a single pair of ovules by each placenta. Paired pendent ovules occur also in the monotypic genus *Draperia*. Geminate ovules are characteristic not only of section *Euphacelia*, but also of such species of *Cosmanthus* as *P. bipinnatifida*, *P. fimbriata*, *P. Purshii*, and *P. ranunculacea*. The numerical situation, alone, is probably an unreliable clue to affinity, inasmuch as tendencies toward reduction in the number of ovules appear to be very widespread among the angiosperms. It may suggest, however, that *Phacelia Dalesiana* is not necessarily particularly primitive.

**CHROMOSOME NUMBER.** The chromosome number of *P. Dalesiana* is  $n=8$  (fig. 1, e), a number known to be shared by

three annual species, *P. glabra* (*Cosmanthus*), and by *P. marcescens* and *P. Quickii* (*Euphacelia* fide Howell, 1943). Of greater interest, perhaps, is the fact that both species of *Hesperochiron* (*H. californicus* and *H. pumilus*) likewise possess eight pairs of chromosomes. (The chromosome number of *Draperia* is  $n = 9$ ; that of *Tricardia* has not been ascertained.) Although chromosome numbers thus far reported in *Phacelia* range from  $n = 5$  to  $n = 24$ , the other perennial species of known cytology show only 9 (*Cosmanthus*), 10 (one species of *Euphacelia*), 11 (*Eutoca* and *Euphacelia*), and 22 tetraploid forms of *Euphacelia*).

GEOGRAPHICAL DISTRIBUTION. *Phacelia Dalesiana* is known to occur only within a very small area—straddling the Siskiyou-Trinity County line in California—on the upper slopes of Scott Mountain in the Trinity Mountains area. This ridge is part of a tangled mass of ranges which contribute to the topographic confusion of the Klamath-Siskiyou region, an area where remarkable species of restricted occurrence are especially abundant. Other species of the genus on Scott Mountain are *P. mutabilis*, chiefly in coniferous woods; *P. Pringlei*, in wet places, especially on or near serpentine; and *P. Greenei* and *P. corymbosa*, largely on drier serpentine or altered rock. In addition, *Hydrophyllum occidentale* grows with *Phacelia Dalesiana* in rather open, sandy, mineralized soil; *Hesperochiron californicus* is abundant in moist situations near at hand; and *Draperia systyla*, which occurs in woods in the same general area, may very probably be found on the same mountain.

On the basis of its acaulescent, perennial habit, entire leaves, scarcely scorpioid cymes, interstaminal scales, deeply parted style, pendent paired ovules, and its chromosome number, it is evident that *Phacelia Dalesiana* combines features common to various other members of the genus, but is not itself referable to any described subgenus or section. The hypothesis of close relationship of this species to any particular species-group would have to depend upon emphasizing a few salient similarities and ignoring striking discrepancies. Certainly no other known perennial species is at all comparable with *P. Dalesiana*; of the annuals, those sharing the inflorescence character differ in other important features, including chromosome complement, and appear to have no real relationship here. Thus, within *Phacelia*, the affinities of *P. Dalesiana* seem to be obscure, but there is also a lack of decisive characters to justify removing the species from the genus. All these considerations appear to recommend retention of *P. Dalesiana* within *Phacelia*, but as a distinct subgenus coordinate with *Cosmanthus*.

PHACELIA subgenus **Howellanthus** subgen. nov. Herbae perennes humiles pubescentes ex rosulis foliorum inte-

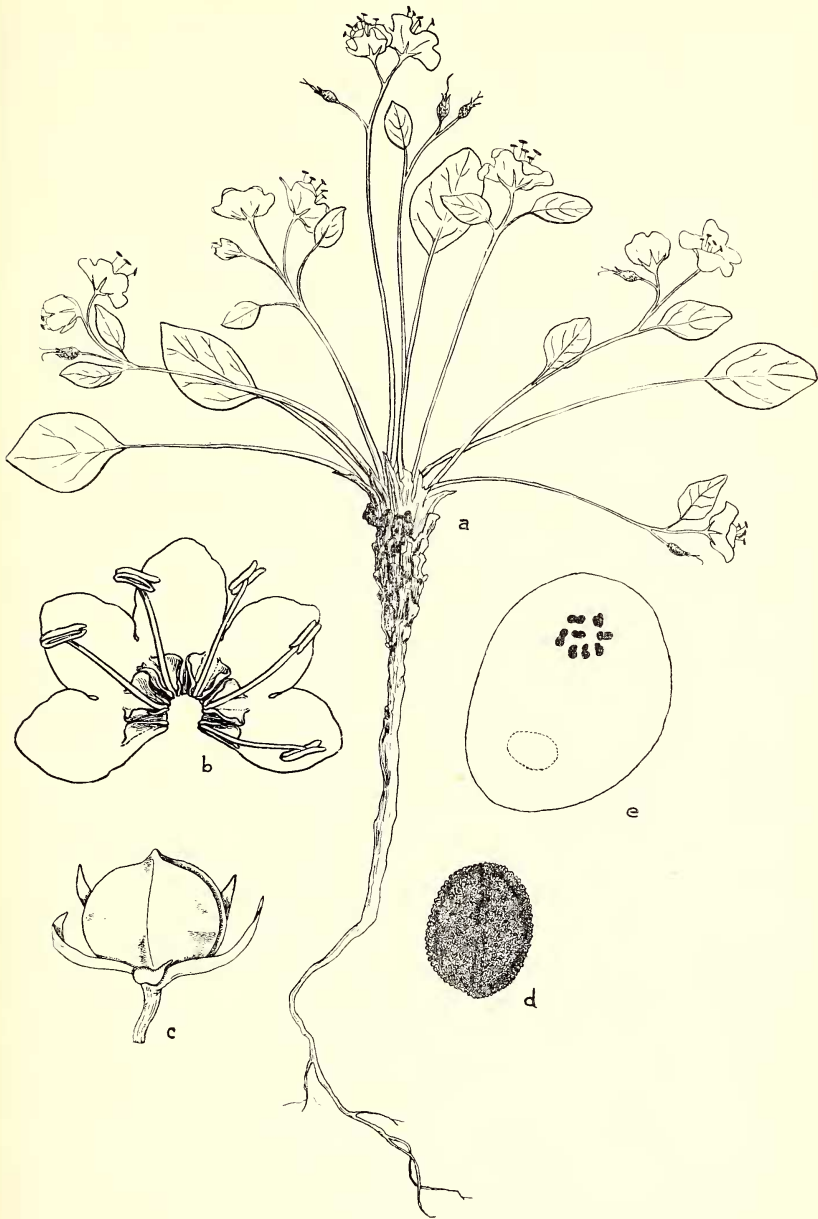


FIG. 1. *Phacelia Dalesiana*. a, habit,  $\times 1$ ; b, corolla,  $\times 2\frac{1}{2}$ ; c, mature capsule,  $\times 4$ ; d, mature seed,  $\times 6$ ; e, chromosome plate, II M,  $\times 1600$ . (All illustrations from Constance & Shan 3070, UC 735,051.)

grorum basalibus foliis caulinis paucis alternantibus oppositive floribus albis in cymis secundis vix scorpioidalibus. Corollae pelviformes staminibus squamis interstaminibus eglandulosis suffultis. Ovarium lateraliter paululum compressum placentis duabus angustis intrusis haud connatis quasi divisum. Ovula exutraque placenta duo seminibus (plerumque duobus) leviter alveolatis sed transversim haud corrugatis.

Low, perennial, pubescent herbs with a basal rosette of entire leaves, the cauline leaves few, alternate or opposite, and white flowers in secund, scarcely scorpioid cymes. Corolla pelviform, the stamens subtended by a pair of conspicuous interstaminal scales, glands lacking. The ovary slightly compressed laterally, incompletely divided by the intrusion of two narrow parietal placentae, which are, however, not grown together. Ovules two to each placenta, the seeds (usually 2) finely alveolate, but not transversely corrugated. Chromosome number  $n = 8$ .

Type species, *P. Dalesiana* J. T. Howell, endemic in the Trinity Mountains area of northwestern California.

There remains to be considered Howell's suggestion that the species "might represent a relictual expression of an ancient type or complex from which not only the genera *Draperia* and *Hesperochiron* developed but also from which species-groups of modern *Phacelia* with less specialized habit and placentation have diverged." There is no intimation that *P. Dalesiana*, itself, has given rise to any other genera or species. *Draperia*, with its trailing, woody stems, opposite leaves, subsessile flowers, tubular-funnel form and shallowly lobed corollas, unequal and unequally inserted stamens, bilobed style, definitely bilocular capsule, and paired pendent ovules, is a monotypic genus with many indications of specialization. Its chromosome complement is 9 pairs. The sole resemblance to *P. Dalesiana*, the position and number of the ovules, would seem to be explicable much more easily as an instance of parallel evolution than as an indication of consanguinity. *Hesperochiron* resembles *P. Dalesiana* in its perennial, acaulescent habit, entire basal leaves, and in chromosome number. The (usually) solitary flowers, the funnellform or rotate corolla, the often unequal stamens with dilated filaments and somewhat versatile anthers, the shortly 2-cleft style, and the numerous ovules and seeds are all points of difference. Thus, *Draperia* and *Hesperochiron* appear to be rather highly specialized types of obscure lineage, the origin of which probably had no close proximity to that of *P. Dalesiana*, which stands sharply isolated even within its genus.

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## GENETIC VARIATION IN ANDROPOGON

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There appear to be three species of *Andropogon* in Nebraska, *Andropogon Gerardi* Vitman (*A. furcatus* Muhl.), *A. Hallii* Hack., and *A. scoparius* Michx.

As a prelude to a taxonomic investigation of the Nebraska andropogons by the junior author, collections were made during the summers of 1949 and 1950 from eighty-three of the ninety-three counties of the state.<sup>1</sup> In making these collections, material was taken only from areas which showed no signs of recent disturbance. This precaution was taken to avoid, as far as possible, the sampling of populations which might be of hybrid origin, and especially those with a short life-span. The tendency for hybrids and other such genetically mixed individuals to occur along roadsides, railway embankments, in cultivated fields, washouts, and other such disturbed areas, has been pointed out by Heiser (1949).

In the field, the variation between the individual plants was very evident. The plants varied in the following respects:

- (1) height of plant—low to tall,
- (2) culm shape—cylindrical or flattened,
- (3) foliage color—green or glaucous,
- (4) anthocyanin content of culm and leaves—marked or absent,
- (5) pubescence of leaf and culm—copious or light,
- (6) anther color—red, yellow, or purple,
- (7) length of rhizome internode—short or long.

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